Featured Capability

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Simulation and Analysis Facility (SIMAF)

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The Simulation and Analysis Facility (SIMAF) is a state-of-the-art U.S. Air Force facility specializing in high-fidelity, virtual (manned), distributed simulation to support acquisition and test located at Wright-Patterson Air Force Base, Ohio. The SIMAF is charged with supporting capability planning, development, and integration in support of Air Force and Department of Defense acquisition program objectives. Key areas of emphasis include capability development and integration, network-centric system-of-system development, and electronic warfare.

Key words: Capability development; network-centric system of systems; communication; horizontal integration; reusability; realistic battlespace environment; distributed test.

Warfare is information-centric, and the future will continue to reward the combatants who are able to communicate across the force in real time, fuse those data, and swiftly apply cognitive reasoning to those data to yield an information advantage over the enemy. Data flows through electronic channels between our forces. The Simulation and Analysis Facility (SIMAF), located at Wright-Patterson Air Force Base (AFB), Ohio, recognizes the need to assess those electronic data between our platforms; command, control, communications, and computers (or C4); and weapons by bringing the best resources of the cross-domain community together through a distributed test bed *(Figure 1)*. The SIMAF was developed to support this objective.

The SIMAF has the ability to conduct large-scale live, virtual, and constructive (LVC) analytically based assessments within the facility or connect to other U.S. Air Force and Department of Defense (DoD) or coalition partners. From the concept of operations and tactics, techniques, and procedures development to the assessment of current or future systems, the SIMAF's expertise spans numerous domains *(Figure 2)*. Our analytical process is based upon system engineering principles with the objective of fostering software reuse and thereby increasing the return on investment for any dollar spent in simulation. Each assessment environment is uniquely constructed from the analytical objectives and implemented using an object-oriented real-time framework. Software and hardware integrated applications are built from that framework. One of our core capabilities includes the ability to build unique integrated hardware and software systems, conduct analyses of these systems in a real-time environment, and deliver usable data analysis products to the acquisition community and to do it quickly. One of our primary goals is to ensure these hardware and software systems are designed to allow for reusability: we enable massive reuse of software objects for each project. As our software object library grows and relationships with distributed partners' mature, project completion times are greatly decreased. Our ability to rapidly construct real-time virtual environments in record time is based on a system engineering process, a reusable object-oriented framework, and automated tools that allow the team to collaborate across the life cycle of an assessment. This complex mission is accomplished by our staff of 20 government employees and over 70 contractors.

The SIMAF was created by the Aeronautical Systems Center in 1995 to fill a gap in the application of manned simulation to support system requirements development and refinement. Since 1995, the SIMAF mission has matured from a single-system focus to a system-of-system focus. Over time, system interoperability matured into network-centric or network-enabled warfare concepts. Today, the SIMAF's mission centers upon decision support necessary to assess the horizontal integration of systems via tactical data links to generate desired battlespace effects. Our mission necessarily encompasses foundational capabilities vital to the successful execution of any mission such as tactical data links and electronic protection and

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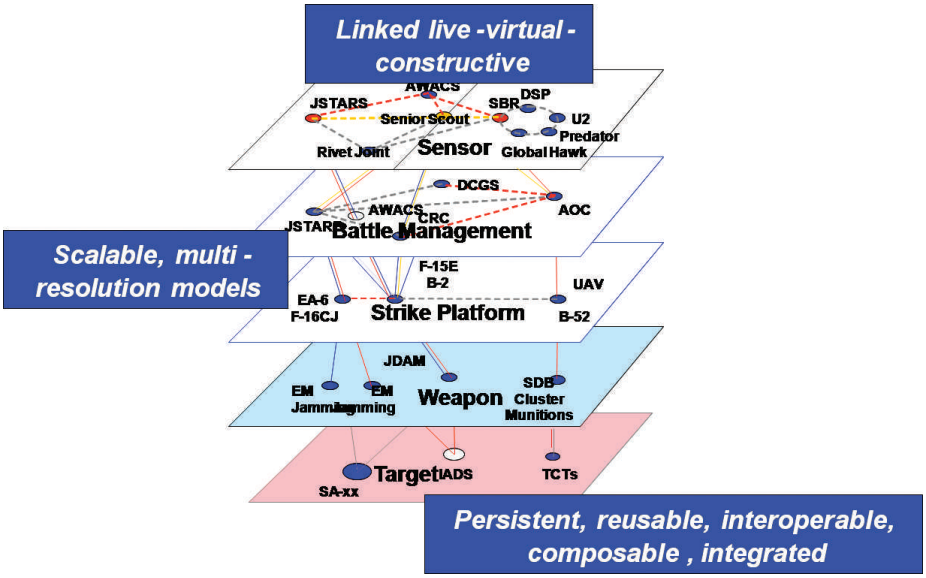

Figure 1. Representation of data flow in a virtual environment.

attack. Since 2000, the SIMAF has established key Air Force and Department of Defense partners via distributed simulation to bring the best of breed from across DoD in support of our customers.

In 2004, the Air Force–Integrated Collaborative Environment (AF-ICE) was created in response to an evaluation gap in the ability to access network-centric weapon systems and provide net compliance testing prior to fielding *(Figure 3)*. AF-ICE is the combination of existing Air Force live (test range assets), virtual (modeling and simulation facilities), and constructive (models) assets in the inventory to evaluate these

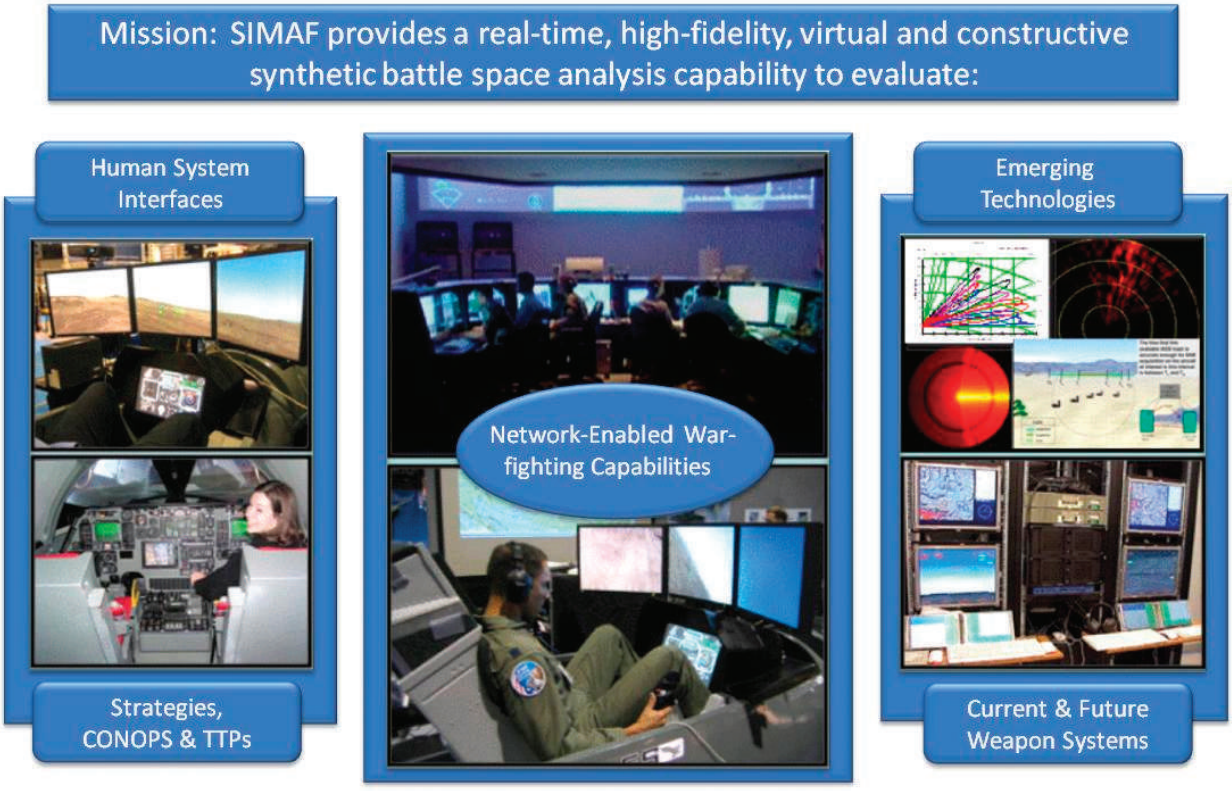

Figure 2. Integrated live, virtual, and constructive environment.

Figure 3. Air Force–Integrated Collaborative Environment.

complex systems. These facilities can be linked together via the Joint Mission Environment Test Capability (JMETC). AF-ICE has facilitated partnerships with other organizations within the LVC community. Examples of these partnerships include the Global Command and Control Innovation Center at Langley Air Force Base, Virginia; the 46th Test Squadron/Data Link Test Facility at Eglin Air Force Base, Florida; and other key service and industry partners such as the U.S. Navy at Patuxent River Naval Air Station, Maryland.

In addition to the relationships the SIMAF has with other Air Force and joint DoD test ranges, we have developed a strong relationship with the National Air and Space Intelligence Center and other members of the intelligence community. The combination of these relationships has allowed us to develop and maintain an ability to generate scalable, valid threat environments to support real-time assessments in a credible, integrated air defense system computer–based representation.

Current projects include Airborne Electronic Attack, Airborne Networking, and Unmanned Aerial System Sense and Avoid. The SIMAF continues to work with our partners to foster improved air and ground modeling and simulation infrastructure in support of joint network design, development, and assessment.

Given the history of building and prototyping capability and partnerships, the SIMAF also is among the thought leaders in facilitating, integrating, and executing events with the main focus to capture credible data useful for decision support. For example, the SIMAF is leading a new activity, Air Ground Integrated Layer Exploration (AGILE). The objective of AGILE is to provide a mechanism to address complex system-of-system assessment objectives by capturing the overarching customer objectives; rendering those objectives into requirements; and satisfying those requirements via analysis through the planning, technical integration, and execution in an LVC environment. The AGILE combined distributed test team will conduct a technical and an operational assessment of the information exchange requirements and broader system interoperability to support conventional mission threads, including Joint Close Air Support, Time Sensitive Target, and Joint Fires. The primary goal is to identify (interoperability) gaps, shortfalls, and overlaps with current systems and networks supporting Joint Fires within and between the Air Force, Navy, U.S. Marines, and U.S. Army air-to-ground communication layers. Additionally, AGILE will assist in defining requirements for the Command and Control Network Partnership and build upon the Joint Forces Command Joint Systems Integration and Interoperability Lab concept in a joint distributed LVC network to support developmental test and operational test agencies.

The LVC network for AGILE will be based on the existing JMETC infrastructure (a long-term SIMAF partner) tying various sites together for event execution. Potential AGILE Fire sites include the White Sands Missile Range, Central Technical Support Facility, SIMAF, Global Cyberspace Integration Center, Electronic Systems Center, Space and Naval Warfare Systems Command, Redstone Test Center, and 46th Test Squadron. The maturing JMETC environment is built on the foundation of an operationally representative construct that allows programs at all stages in the acquisition process the opportunity to quantitatively test/assess their performance.

Future of distributed test

With AGILE Fire (and other activities), the SIMAF is partnering with several organizations within the DoD to address critical factors in distributed testing. One of those factors is the nature of the historical acquisition process. Our acquisition and test culture is system-centric. Additionally, our acquisition and test processes are serial and independent processes. Finally, the service acquisition and test cultures do not readily lend themselves to the concurrent acquisition and testing of air and ground systems within a broader, more expansive concept of operations. The result is anything but interoperability. Perhaps the most difficult aspect is to change the culture and policy. System-of-system interoperability is reliant on distributed environments. The SIMAF has a focus on distributed testing, but overall success requires the community to increase the confidence level of program managers, primes, testers, and many other disciplines, to include the operational force and analysts, that the event data are credible. Furthermore, DOT&E needs to capture the continuum of activity leading up to a "system" operational test. An assessment environment that can provide early insight for program managers and primes through continual assessment opportunities, for all programs big and small, will increase the program managers' comfort level and will be seen as a benefit rather than a burden. This approach needs to map to a mission context and comprise combined service/joint assets so technical and cognitive effects can be understood. Moreover, regardless of where a system or technology is in the acquisition cycle—from milestone A through full operational capability—this continual assessment/insight–early influence business model provides opportunities to understand system attributes in a combined service environment without the gravity of a milestone decision. Using a flexible, disciplined approach within the acquisition community, from individual acquisition programs to emerging technologies that "touch" many platforms, will provide the means to effectively use distributed environments with confidence, reducing overall acquisition and test cost while providing increased confidence that systems will interoperate in the field.

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M. Walter March's duties include providing input to the technical direction for the Aeronautical System Center Simulation and Analysis Facility in the design, development, and integration of multiservice live, virtual, and constructive (LVC) environments to provide decision support to the U.S. Air Force/Department of Defense acquisition and test and evaluation (T&E) community. He was the Air Force lead for the Office of the Secretary of Defense–sponsored Multi-Service Distributed Event; the overall integration lead for the Integral Fire 2007 LVC Event, which included 19 multiservice/Joint Forces Command sites from across the United States focused on Joint Close Air Support and Integrated Fires; and the integration lead for Persistent Fire 2009. He has over 22 years' experience in the T&E/Modeling Simulation & Analysis discipline. Mr. March has supported multiple T&E efforts to include the B-2 Bomber. As a support contractor, he was the Air Force Operational Test Center B-2 test manager; primary responsibilities during the Initial/Final Operational Test and Evaluation and Force Development Evaluation efforts included test plan development, pretest planning, test execution, data reduction, data analysis, and report writing. E-mail: martin.march@wpafb.af.mil